Quarterly Status Report

(July 8, 1966)

Contract R-80

between

The National Bureau of Standards

and

The National Aeronautics and Space Administration

April 1 through June 30, 1966

1. Electron transmission. An improved Monte Carlo program (ETRAN 9A) has been put into operation which treats bremsstrahlung loss straggling, and includes secondary knock-on electrons. In these respects, the new program is an improvement over the previous program ETRAN 5 E; in other respects it is identical with it. Various model studies have been run with ETRAN 9A in order to determine the optimum sizes of various parameters, and a sample of 30,000 histories has been generated for comparison with the transmission data of Jupiter and Merkel (GA) for 8.2-Mev electrons incident on aluminum. The agreement obtained is satisfactory. Details of the comparison and of the method of computation have been put down in a memorandum to A. Reetz (NASA Headquarters) dated June 14, 1966.

The program ETRAN 5E has been applied at MSFC Houston in a systematic manner to the calculation of the transmission of electrons with energies between 0.5 and 6 Mev through aluminum targets with thicknesses up to one range, for an omnidirectional electron flux (cosine-law distribution of incident electron current). Very large samples (up to 100,000 electron histories) have been generated for each case, so that good statistics have been obtained for joint angular-energy distributions of transmitted radiation. Mr. Manuel Lopez, who has been in charge of running the program at Houston, plans to compress and consolidate the information obtained in many individual runs. This condensed information, which is expected to be available in a few weeks, will still be too extensive for publication as a report. It is planned to excerpt some portions for publication, and to make the remainder available to the public on microfilm or a similar medium.

2. Thick-target bremsstrahlung. Additional calculations have been made for gold targets (source energies 1 and 2 Mev) for comparison with new data from LTV, and for tin and tungsten targets (source energies 50 and 100 kev) for comparison with data of Placious (NBS). Again, satisfactory agreement was obtained. Substantial progress has been made with the preparation of a manuscript describing these and all previous results.

3. Energy dissipation by electrons in the atmosphere. The program SPIRAL which takes into account the motion of electrons in an atmosphere with variable density, under the influence of the earth's magnetic field, has been put into limited operation at Goddard SFC. As the result of the experience gained thereby, the program has been altered in respect to the manner in which the required information is extracted from the sampled Monte Carlo histories. The results obtained by the new scheme will not differ significantly from those obtained previously, but the amount of computation time necessary for a given level of accuracy will be reduced by a factor of at least four. The new program is almost ready to be put into production.

4. Composite slabs. Work has been done on a computer program which has the purpose of calculating the energy deposition by electrons in a composite slab consisting of several layers of different materials. This program should be useful for estimating radiation damage to the hull of space craft. For the time being the calculation is being done in the continuous-slowing-down approximation which is adequate for the computation of energy deposition. The same technique for treating a composite medium could also be applied, however, to the more refined electron transmission program ETRAN.